

DATE: August 30, 1976

TO : Joshua Lederberg

FROM : George M. Hahn

SUBJECT: Interaction of Radiation with Ultrasonic and Infrared

Josh, I know nothing about any interaction of chemotherapeutic agents and infrared except of course for the effect of increased temperature. I think the papers that you refer to on the increased incidence of chromosome aberrations all involve increased temperature, and I strongly suspect that the measured increases were in fact a result from the heating. I don't know how much IR work has been done in conjunction with radiation affecting space flight, but I don't think that is too much of a problem. After all, its relatively easy to shield out infrared. Of much more concern I think is the ionizing radiations, particularly heavy particles which are essentially impossible to completely shield.

As an aside, this business by Krenkau on the use of ultrasound to enhance uptake of drugs, we have recently done a lot of work with ultrasound on solid tumors. Even without chemotherapy it is surprisingly easy to sterilize a tumor. When I compare the possibilities of ultrasound with X-ray, I am lead to believe that perhaps within the next 5-10 years a fair chunk of X-ray therapy will be replaced by ultrasound therapy.